

## **SPATIO-TEMPORAL ANALYSIS OF SOIL MOISTURE DYNAMICS USING SENTINEL-1 AND SENTINEL-2 SATELLITE IMAGERY**

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Remote sensing has been widely used in surface water studies such as surface water bodies, their dynamics, vegetation water content, peatland and wetland monitoring, or soil moisture. However, the analysis of the latter poses many challenges, as the imagery provides information limited to the surface. Various spectral indicators were developed for water-related analysis, but they often require verification with *in situ* measurements that represent only selected points in space. The purpose of this study is to investigate spatio-temporal changes in soil moisture, and their effect on radar images, using only remote sensing data.

The study was based on open access radar and optical satellite imagery acquired by the European Space Agency (ESA) Copernicus missions Sentinel-1 and Sentinel-2, respectively. The analysis period was 2019-2023. Two case study sites representing different environmental conditions were selected. The first was an earth-filled dam in southern Italy, while the second an agricultural area close to an underground gas storage site, in northern Poland. Pre-processing of optical images was performed in Google Earth Engine, while radar data were processed using SNAP. The cloud-masked S-2 images were used to compute several spectral indices used for the assessment of water and vegetation. The indices were differentiated with respect to the master image date so that they could be compared to the SAR coherence images.

The study results showed a significant correlation of up to 0.8 between SAR coherence and the selected spectral indices. The findings highlight the potential use of SAR coherence in soil moisture studies.